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PROCESS FOR PROGRAMMING A MEMORY AND DEVICE FOR THE EXECUTION OF THE PROCESS  
[Verfahren zur Programmierung eines Speichermittels und Einrichtung zur  
Durchführung des Verfahrens]

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The invention relates to a process for programming a memory, as well as a device for the execution of the process, in accordance with the preamble of Claims 1 and 4.

Such processes, for instance, are appropriate for the application-specific programming of a memory of a programmable control and regulating unit.

A process of the kind mentioned in the preamble of Claim 1 is familiar to the art (EP 0503256A1) in which logical data for functional blocks of a functional block library are stored in a read-only memory of a control and regulating unit. The functionality of the control and regulating unit is determined by the content of the logical information and, hence, to a large extent, can be composed by means of an appropriate configuration of the logical information; this has the advantage that the control and regulating unit can be adapted to diverse tasks.

The price deemed acceptable by a person purchasing the control and regulating unit is essentially dependent upon the functionality of the control and regulating unit.

The invention is based on the objective of specifying a process for programming a memory through which the market value of the programming is compensated while creating a device with which the process can be executed.

In accordance with the invention, the mentioned objective is realized by means of the characterizing features of Claims 1 and 4. Advantageous configurations ensue from the contingent Claims.

Processes for providing services with the assistance of a prepaid card are generally familiar to the art (e.g., A. Beutelspacher, et al., Can you pay with bits?, Informatics Spectrum, Springer Publishing House, 1993, 16: 99 - 106).

Configuration examples of the invention will be explained in greater depth below.

The following is shown:

Figure 1, an electronic device with a program element which is composed depending upon the application,

Figure 2, a device for preparing the program element, and,

Figure 3, a data flow chart for the preparation of the program element.

In Fig. 1, (1) means an electronic device exhibiting a processor (2), a memory arrangement (3), as well as input and output interfaces (4). For instance, the electronic device (1) may be a control and regulating unit, the functionality of which is dependent upon a program element (5) which is stored in a space of the memory arrangement (3). The input and output interfaces (4) are configured for sensors and control elements.

The functionality of the control and regulating unit contains the dynamic behavior of the regulating unit, the time behavior of signals at the output interfaces, as well as the conversion or limitation of signals to the input and output interfaces (4), for instance.

If required, the memory arrangement (3) exhibits various familiar memory building blocks or memory systems. Examples include programmable

read-only memory (PROM), erasable programmable read-only memory (EPROM), and random access memory (RAM), or also magnetic memories.

The program element (5) is configured according to the intended purpose of use of the electronic device (1) and advantageously filed in a read-only memory in the memory arrangement (3).

The program element (5) is a part of the program system serving the purposes of unit (1) which can be executed by the processor (2). The input and output interfaces (4) are operated through the program system.

In Fig. 2, a computer - for instance, a PC or a so-called work station - is marked with (6), on which a process (7) can be initiated which has a software library (8). The process (7) is a program or program system which runs on one or several processors.

The computer (6) is connected with a first device (9) and a second device (10). A memory (11) can be programmed with the first device (9).

The value of a prepaid card means (12) can be read and also changed with the second device (10).

A so-called prepaid electronic coupon (Informatics Spectrum, Springer Publishing House, 1993, 16: 99 - 106) represents an example of the prepaid card means (12). The second device (10) is a device for reading and changing the coupon value which is matched to the prepaid card means (12).

The memory (11) is programmed with the program element (5), meaning that the code of the program element (5) is preferably created or composed with the assistance of the process (7) and stored in the memory (11), whereas the process (7) of the software library (8) is used in which

elements - for instance, sub-programs and/or tables - are available assisted by which the functionality of the electronic device is composed and configured by an operator of the computer (6) who partially controls the process (7).

While composing and configuring the code of the program element (5), the operator is advantageously guided by the process (7) through graphics and/or menus, for instance. The process (7), for instance, offers the operator a menu with the functions that can be selected from the software library (8) and/or the process (7) asks the operator questions concerning the desired functionality of the device (1).

The memory means (11) is a part of the memory arrangement (3). Preferably, the memory means (11) is a read-only memory - for instance, an EPROM - which is built into the electronic device (1) after it has been programmed.

The basic data flow for preparing the program element (5) can be deduced from Fig. 3 from a representation form which is familiar from the pertinent literature (D.J. Hatley, I. A. Pirbhai: Strategies for Real-Time System Specification, Dorset House, NY 1988). In the chart, a circle means an activity, a square means an adjacent terminator, and an arrow means a communication channel for the transfer of data and/or events, whereas the arrow tip points into the essential data flow direction. A data pool which generally is available for several activities is represented by two parallel lines of equal length. Besides that, an arrangement of two activities that are connected by a communication

channel, for instance, are equivalent to one single activity which carries out all tasks of the two activities.

The prepaid card means (12) exhibits a first data memory (13) for a prepaid credit balance (W) and, if required, a second data memory (14) for a user privilege (R). The process (7), which is shown as an activity, is connected with the first data memory (13), via a channel, with the second data memory (14) by the software library (8) and with the program element (5) by means of an input/output device (15) of the computer (6) (Fig. 2).

The input/output device (15), preferably, is a screen terminal with graphic capabilities.

An advantageous process for programming the memory (11) for the electronic device (1), the functionality of which is dependent upon the contents of the memory (11), exhibits at least four steps that are described below, which are advantageously executed or prompted by the process (7):

- a first step in which the program element (5) is generated with the assistance of a device consisting of the computer (6) with the process (7) and the software library (8), which causes the desired functionality of the device (1).

- A second step in which a predetermined price, which is dependent upon the generated program element (5) is automatically computed by means of the process (7), whereas the price is advantageously dependent upon the size and/or the complexity of the program element (5).

For the benefit of flexible pricing, the software library (8) exhibits data for the computation of prices which relate to its elements

- for instance, the price tariff of each element. A price which is supported by the functionality of the electronic device (1) that has been configured in the program element (5) can thereby be computed, whereas even the costs which are incurred in the development of specific elements of the software library (8) are taken into account according to the expenditure.

- A third step in which the price is automatically charged by the process (7) in the prepaid card means (12) and the program element (5) is automatically cleared for storage in the memory (11) following the successful deduction of the prices.

While the charge is deducted, the credit balance (W) is reduced by the price of the program element (5) in the first data memory (13).

- A fourth step in which the memory (11) is programmed with the deducted and cleared program element (5) through automatic storage of the program element (5) in the memory (11).

In the fourth step, in a first variant of the process, a set of data which depends on the functionality of the device (1) is stored in the memory (11) in addition to the program element (5). Advantageously, the set of data exhibits a signature which, if required, contains the user privilege of the computed price, a price category, or description of the program element (5), while facilitating a possible future review or evaluation when the electronic device (1) is operated, for instance.

Advantageously, the generation of the program element (5) and, therefore, the functionality of the device (1) is configured so that it is limited by the user privilege (R), which is assigned to an available partial function of the device. The user privilege (R) is advantageously



assigned for the elements of the software library (8) element by element.

Due to the limited generation, a user-dependent utilization of the functional options of the electronic device (1) can be realized if required, so that predefined partial functions are not made available to a certain category of users, for instance.

The inclusion of a regulating or control function which is generally available to the software library (8), for instance, is either cleared or then prevented by the user privilege (R).

In an advantageous variant, the applicable user privilege (R) is also stored in the prepaid card means (12).

Advantageously, the prepaid card means (12) is a familiar value card, for instance, a smart card, and optically encoded card or a magnetic card.

A card of the standard ISO 7816 of the International Organization for Standardization is an example of the prepaid card means.

As a result of the fact that, during the generation of the program element (5), its price is automatically computed and the program element (5) is automatically cleared for storage in the memory means (11) only after the successful compensation, the market value of the program element (5), which is dependent upon the functionality of the electronic device (1), is securely deducted in a simple manner.

Together with the credit balance (W), the desired step of the user privilege (R) can be sold to a customer in the form of a card, whereas the credit balance (W) generally is advantageously provided for the configuration of several device (1) pieces.

The disclosed process makes it possible for the manufacturer or buyer of the electronic device (1) to proceed as follows, for instance:

- The manufacturer produces the electronic device (1) in large lots and generally delivers several devices (1) to the buyer without the program element (5) for a relatively low price.

- Moreover, the manufacturer sells the prepaid card means (12) which exhibits the credit balance (W) desired by the purchaser, as well as the user privilege (R) which is matched to the purchaser's application or operational requirements.

- Apart from this, the manufacturer acts as an agent or seller of the system with the computer (6), the software library (8), and the process (7), for the execution of the process for the delivered pieces.

- The purchaser configures the electronic devices (1) in accordance with his requirements, whereas the price for each piece is respectively automatically computed in relation to its functionality and deducted in the prepaid card means (12).

By means of the process, the costs incurred in the development of the electronic device (1) and in the development of the software library (8) are reliably and automatically charged in an advantageous manner, whereas the purchaser of the device (1) is only charged for the functions that he builds into the program element (5).

The process is generally usable for electronic devices, the functionality of which can be composed through an application-oriented use and the combination of available software elements.

The described process can be transferred to additional electronic means of payment - for instance to prepaid card means.

#### **Patent Claims**

1. Process for programming a memory (11) for an electronic device (1), the functionality of which is dependent upon the contents of the memory (11), characterized

in that a system (6, 7, 8) is used with which a program element (5) bringing about the desired functionality of the device (1) is generated,

in that a predetermined price which depends upon the generated program element (5) is computed,

in that, by deducting the price, the program element (5) is cleared for storage in the memory (11), and,

in that the program element (5) is stored in the memory (11).

2. Process in accordance with Claim 1, characterized in that, in addition to the program element (5), a set of data which depends upon the functionality is stored in the memory (11).

3. Process in accordance with any of the previous Claims characterized in that the generation of the program element (5) and, thus, the functionality of the device is designed so that it is limited by the user privilege which is assigned to an available partial function of the device (1).

4. Process in accordance with Claim 3, characterized in that a means is used as a prepaid card means (12) in which the applicable user=s privilege is also stored.

5. System with a computer (6) for the execution of the process in accordance with any of the previous Claims, characterized

in that a process (7) is available for the computer (6) for which a software library (8) is provided with elements for the composition and configuration of the functionality of the electronic device (1),

in that a system (10) for reading and changing the prepaid card means (12) is available for the computer (6), and,

in that a system (9) for storing the program element (5) generated in the process in the memory (11) is available.

6. System in accordance with Claim 4 characterized in that the prepaid card means (12) is a prepaid value card.